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Aggregate Trends in Four Main Agricultural
Regions in Egypt: 1964-1979

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ABSTRACT

In this paper, aggregate trends in the crop production of four main agricultural regions in Egypt are considered. We find that in all regions aggregate output growth rates had declined in the mid-seventies, but there has been some improvement in the performance of the Delta region towards the end of the decade. However, there is more similarity among the trends in the real output prices in the four regions. Profitability has moved counter-cyclically and its growth has been fastest in regions where output growth has been slowest. These observations provide time-series and cross-sectional evidence for the hypotheses that aggregate output is not responsive to prices, that the elasticity of substitution among land, labor and other agricultural inputs is rather low, and that output is essentially driven by land-augmenting factors. Thus, increased investment in agricultural infrastructure is expected to raise output growth and, at the same time, to increase labor's share in production at the cost of the share of property. Labor share also seems to have gone up more in regions where the real wage has grown faster, suggesting a rather inelastic demand curve for labor in Egyptian Agriculture. Therefore, channeling the excess of other sectors' labor force towards agriculture may lead to a deterioration of rural income distribution.

AGGREGATE TRENDS IN FOUR MAIN AGRICULTURAL REGIONS
IN EGYPT: 1964-1979

Studies of Egyptian agriculture are often concerned with the
country-wide indicators of crop production and prices. This may seem
natural since the agricultural lands in the Nile Valley and in the
Delta, in contrast with their surrounding deserts, seem so uniformly
fertile. However, a closer look soon reveals that the cropping pat-
terns of various geographical locations in Egypt are quite different.
Thus, the question arises whether the assumption of similarity among
various zones does not obscure our understanding of the sector's beha-
vior. In this paper, we intend to examine the differences and simi-
larities of four main agricultural regions in Egypt in order to find
out what kinds of results can be generalized for the country as a
whole and what kinds have to be dealt with at the regional level.

A further motivation for the study of regional agricultural
behavior is to provide cross-sectional evidence for a number of impor-
tant hypothesis regarding the behavior of the agricultural sector in
Egypt; e.g. the role of government price policies in the slow growth
of the sector and the possibility of using agricultural employment as a
shock absorbent for the labor markets in the rest of the economy.
Elsewhere we have tested these hypotheses against country-wide time-
series data (Esfahani, 1985). In this paper we intend add cross-
sectional evidence supporting our earlier findings. In particular,
our observations confirm the results that agricultural price policies
could not have played a major role in the determination of aggregate
output, and that although both demand and supply of agricultural labor

respond to fluctuations in the real wage rate, their elasticities are likely to be rather low. This latter result implies that income distribution may greatly deteriorate if agriculture is forced to take up the slack of employment in other sectors. Thus, employment stability, rather than variability, may be a policy priority.

In this paper, the focus of our study is on the aggregate indicators of agricultural performance. We will construct indices such as aggregate output, aggregate price level, factor shares, and total agricultural employment in order to depict a broad view of the developments in Egyptian agriculture [1]. This is in contrast with most other studies which deal with the productions and prices of individual crops and fail to provide comprehensive analyses of the sector as a whole.

For aggregation purposes we use the <u>Tornqvist-Theil</u> indices which have proven to be reasonable approximations to the 'true' indices of aggregate variables (Diewert, 1976). These indices are certainly quite superior to the constant-price ones usually employed to measure fluctuations in the 'real' aggregate volume and price of sectoral products. Our data base comes form the Ministry of Agriculture of Egypt and extends from 1964 to 1979. An extensive discussion of the data base can be found in Esfahani (1984).

The plan of the paper is as follows. The characteristics of the four regions are discussed in Section 1. In Sections 2 and 3, the main trends in productions and prices in different regions are examined. Fluctuations in the agricultural wage and employment are the subject of Section 4. The question of variability of returns to the factors of production is left to Section 5. Section 6 is devoted

to the issues of the trends in non-factor (intermediate) inputs and of technical change. Section 7 looks at the development of agricultural infrastructure and investment. And, finally, Section 8 is the summary and the conclusion of the paper.

1. The Four Agricultural Regions.

In Egypt, agricultural data is classified according to governorates which do not necessarily correspond to agronomic zones in the country. Therefore, any categorization of these governorates is bound to be an imperfect representation of agronomic zones in Egypt. However, there seem to be four more or less homogeneous groups of governorates with interregional differences--significant enough to outweigh the intra-regional variations by and large. Our close examination has shown that given the limitations of the data, partition of governorates according to these four groups has the advantages of preserving the parsimony of presentation while displaying the main regional distinctions.

The first region is composed of six governorates in the Nile Delta--namely, Beheira, Gharbiya, Kafr el-Shaikh, Daqahliya, Domyatta, and Sharqiya--with similar agronomic conditions and comparable cropping patterns. One of the main common characteristics of these six Delta governorates (SDG) is the production of rice which is hardly cultivated in other regions of Egypt. Table 1 indicates that besides rice, crops such as berseem (Egyptian clover), cotton, maize, and wheat are also among the main ones produced in the SDG region. Note that all other crops, except for tomatoes and potatoes, have revenue shares of less than one percent in the total value of crop production

in this region. In the period between 1965 and 1979, the share of
potatoes and tomatoes has expanded rapidly, while the shares of cot-
ton, rice, and beans have declined. On the other hand, the shares of
berseem (long- and short-season together), of maize (summer and nili),
and of wheat have remained roughly constant. These Six Delta
Governorates form the most important agricultural zone in Egypt which
accounts for more than half of the total value of crop production in
the country (see Table 2).

The second region, which is also partially located in the Delta,
is mainly composed of governorates in the vicinity of major urban cen-
ters, and for that reason has a horticulture-oriented cropping pat-
tern. This feature is particularly reflected in the large shares of
potatoes and tomatoes in the total crop revenue of this region (see
Table 1, under 'Urban Governorates' (UG)). Berseem and maize--the two
major animal feed crops in Egypt--are also significant in this region,
probably due to the fact that these crops are highly needed for produc-
tion of milk and meat which are in great demand in urban areas.

In the UG region, production of wheat seems to be as important as
it is elsewhere, but cotton has less significance here. This region
produces about 16 percent of the total crop value in the country
(Table 2). It consists of the following eight governorates:
Alexandria, Suez, Minufiya, Qalyubiya, Cairo, Port Said, Tahrir, and
Giza [2]. The SDG and UG regions minus Giza are commonly known as
Lower Egypt (LE). In official data, Giza is considered a Middle Egypt
governorate. However, since it is close to Cairo and its agriculture

has the characteristics of the other Urban Governorates, we have included it in this region.

The third region consists of Beni Suef, Fayyum, and Minya, and will be referred to as Middle Egypt (ME). This region used to be a major cotton producer, but in recent years the role of cotton in its agriculture has declined considerably. Instead, berseem, maize, sugar cane, and tomatoes have increased their shares in production. Unlike Lower Egypt, ME produces more beans, sorghum, and sugar cane. Rice is produced in only one governorate; namely, Fayyum. This region has been slowly losing its share in the total crop production in Egypt—from over 17 percent in 1965-67 down to below 15 percent in 1977-1979 (Table 2). This loss of production share by ME has been picked up mainly by the SDG region.

The fourth region, Upper Egypt (UE), covers the five southern governorates of the country: Asyut, Sohag, Qena, Aswan, and the New Valley. Upper Egypt is a major producer of sugar cane, sorghum, onions, and lentils. Wheat and beans have also large shares in its total crop production. Shares of berseem, cotton, and maize, on the other hand, seem to be much less important when compared with other regions. A noticeable trend in the cropping pattern of Upper Egypt during the 1964-1979 period is the rapid expansion of sugar cane production at the cost of most other crops. Another important fact about UE is that vegetables--potatoes and tomatoes--have a relatively small role in its agriculture. Among various reasons, the distance from major urban centers may certainly help explain this observation. Finally, it should be mentioned that Upper Egypt has more or less

maintained its 17 percent share of the country-wide agricultural output.

In the following, we will see how these regions have developed differently over time due to their geographic and agronomic distinctions and also due to the differences in the policy treatment that they have received.

2. Agricultural Production.

The agricultural sector of Egypt as a whole experienced relatively high rates of growth in the late sixties, as Table 3 indicates. According to the estimates of various sources, the average rate of growth of Egypt's agricultural sector in the fifties and sixties has been about 2.0 percent per year (Ikram, 1980, p.172). This rate agrees with our estimate of the average growth rate in the second half of the sixties. However, the sector's growth through time has not been uniform: a negative rate of growth before 1967 turned into a relatively high positive rate between 1968 and 1970 which perhaps can be attributed to favorable weather, to the recovery of the country from the 1967 War, and to the completion of the Aswan High Dam and its complementary irrigation projects. In the seventies, the agricultural growth rate did not fluctuate much, but it dwelled at quite low levels; it fell rather sharply at the beginning of the decade and started to recover very slowly only after 1974. Average growth rate for the whole 1964-1979 period was 1.46.

Let us now look at the break down of the agricultural growth rates into the contributions of the four regions distinguished above. The first observable point in Table 3 and Figures 1-4 where we present the

three-year moving averages of the aggregate growth rates is that there
is some similarity among the aggregate agricultural performances of the
four regions in the sixties and seventies: all regions experienced low
growth rates in the mid-sixties and mid-seventies, with a boom some-
time between those two troughs. The SDG region had high growth rates
around 1970 and, after stagnating for several years, has been moving
towards a recovery in the late seventies. The UG region has also per-
formed similarly, except that its trough in the first half of the
seventies was much deeper and its growth in the second half of the
decade has been consistently more vigorous. It is interesting to
note that Upper Egypt has had a similar cycle, but with a few years
lag: it benefitted from a longer lasting impact of the Aswan High Dam
in the early seventies but showed negative rates of growth towards
the end of the decade. Middle Egypt, on the other hand, has had more
frequent fluctuations and greater tendency to stagnate and decline.
It should, however, be mentioned that the Fayyum governorate is rather
different from the other two governorates in this region and has been
growing somewhat more vigorously throughout the seventies.

One can of course trace the aggregate performance of these four
regions back to the movements in production of individual crops.
Naturally, in each regions certain crops have been more important in
determining the rhythm of growth. In the SDG and UG regions, for
example, expansion and decline of cotton, rice, beans and vegetables
have had significant impact on the growth cycle (see Tables 3 and 5).
The role of vegetables has become particularly important in the Urban
Governorates in the late seventies which happens to coincide with the

time of rapid expansion of the urban economy in Egypt. At various
points in time, some other crops have also played considerable roles
in the SDG and UG regions. For example, growth of wheat and summer
maize outputs were important in the agricultural expansion of the late
sixties, while revitalization of nili maize production in the late
seventies has contributed to the more recent recovery of the two
regions. In case of Upper Egypt, lentils, sesame, maize, wheat and
vegetables were important both in the upturn and in the downturn.
However, the rapid decline in the production of cotton and sorghum was
instrumental in turning the rate of growth UE's agriculture negative.

3. Agricultural Prices.

Table 4 gives three-year moving averages of nominal price changes
in rural Egypt. The first striking observation in this table is that
despite the differences in the cropping patterns, the aggregate
output-price indices have behaved rather similarly in the four
regions. Between 1965 and 1967 aggregate output-prices rose almost
at the same rate as did the average agricultural nominal wages, while
the cost-of-living index in rural areas declined. This process was
reversed between 1968 and 1970, when output prices fell, nominal wages
stagnated, and the cost of living rose rapidly. This radical shift of
gears was perhaps due to the fact that after the 1967 War and the sub-
sequent development of foreign exchange shortages, the government could
no longer finance its 'equitable growth' policies and, thus, chose to
resort to heavy taxation of agriculture.

In the early seventies output-price indices seem to have grown faster than both the wage rate and the cost-of-living index. However, in the mid- and late-seventies wage inflation took off and surpassed output-price and cost-of-living indices which were growing at about the same rates [3]. Note that if the revenue per feddan of berseem (given in Table 5) is taken as a proxy for the cost of animal power used as an input in agriculture, one finds further indication that profitability of crop production may have been squeezed in the late seventies. However, if prices of beef and milk are considered as alternative proxies for the cost of animal power (given in bottom of Table 5) and subsidies on other inputs such as fertilizers, fuels, and machinery are taken into account, the picture may becomes less clear.

In order to better understand the movements in the real aggregate prices, we have constructed aggregate Tornqvist-Theil input-price indices for the four regions and deflated them by the aggregate output-price indices (for details see Section 6 below). The graphs of three-year moving-average growth rates of these aggregate real input-price indices are presented in Figures 1-4. These graphs strongly indicate that variations in the cost of crop production have been very similar in all four regions: real input costs were high in the late sixties; they fell rapidly in the first half of the seventies; then they rose sharply in the second half of the decade and, finally, stabilized towards the end of the period.

A simple comparison of aggregate production and real input-price growth rates in Figures 1-4 reveals a clear pro-cyclical movement

in input prices relative to output prices. This is rather puzzling, since production is often supposed to change in direct response to changes in real output prices. However, the puzzle may be resolved if production is not price responsive and is indeed strongly driven by exogenous factors, such as infrastructure, which are complementary with variable inputs. If this is the case, changes in the stock of infrastructural capital will shift the demand for variable inputs and move their prices along their supply curves.

Note that despite regional similarities in relative price behavior in the seventies, outputs of the four regions have followed rather different paths. This adds a new cross-sectional piece of evidence as to the weakness of price effects on production, strengthening our case for the importance of non-price factors in Egyptian agriculture. More on this later.

4. Wages and Employment.

Between 1964 and 1979 nominal agricultural wages rose almost six-fold (Table 6). Although most of this increase was washed away by inflation, nonetheless according to the index in columns (3) and (5) of Table 6, in the 64-79 period labor must have gained about 4.5 percent per year in terms of real consumption as well as relative to output prices. However, the growth of the real wage rate in the sixties and the seventies was not uniform. After a modest growth in the late sixties, the real product wage stagnated and then began to fall rapidly in the the first half of the seventies. This situation changed sharply after 1974 and the real wage made large gains in 1975 and 1976. By 1977,

output-price inflation had caught up with the wage increases and the agricultural real wage even fell somewhat in 1978, but it was more than compensated by the big jump in 1979.

Regional nominal wages are available for the 1968-1978 period only. Table 7 presents this data, along with the real product-wage indices for the four regions. The trends in these indices are essentially the same as in the country-wide index discussed above. Figures 5-8 present the graphs of the real wage growth rates in the four regions. In these figures, we have extrapolated the regional nominal wage rates by regressing their available observations on the country-wide average wage rate [4]. The graphs clearly demonstrate the similarity among regional real wage behavior and their increased variability in the seventies.

The purpose of Table 7 is to provide a picture of regional wage differences. The growth of real wages has been highest in Upper Egypt, and decreases as one moves north towards the Delta region. Note that nominal wages have also been relatively high in Upper Egypt, particularly in the seventies when they were only second to the corresponding rates in the Urban Governorates. Middle Egypt, on the other hand, has had the lowest nominal wages in the country.

It may be relatively easy to understand why wages were so high in the Urban Governorates, but it is not at all clear why wages were growing so fast, and ended up so high, in Upper Egypt. Trying to tackle this question, Mohie-Eldin (1979) suggests that the concentration of small family farms and the proportion of landless wage labor must have been among the determinants of agricultural wage rates

in Egypt. He argues that prevalence of small family farms reduces the elasticity of labor supply and increases the wage response. However, by the same token one may expect the demand for agricultural labor to be more elastic and reduce the variability of the wage rate. The more problematic part of Mohie-Eldin's suggestion is that his data shows the same proportion of agricultural labor force residing in small farms in Middle and Upper Egypt, while the wage rates in these two regions are far apart. Mohie-Eldin also mentions the greater migration of agricultural workers from Upper Egypt to Libya, which might be an answer to our question, but at the same time, raises a new question to be explored in its own right. The question now becomes: why migration has been higher in Upper Egypt where real wages were growing faster than other regions? Another factor mentioned in the literature to explain the observed regional wage pattern is the low participation of women in the agricultural labor force in Upper Egypt which has a more traditional social environment. However, a piece of evidence which might be an important clue to the wage differentials question is the fact that while agricultural employment has declined in all other regions, in Upper Egypt it has increased over time (see Table 10). Thus, the shifts in the labor demand schedule in UE--perhaps caused by the rapid expansion of the cultivated area of sugar cane--must have been strong enough to raise wages faster than in other regions and, at the same time, to increase employment despite the large wage increases. It should be mentioned that sugar cane is one of the most labor intensive crops in Egypt (Mohie-Eldin, 1979, Table 7) and has a large share in the cropping pattern of Upper Egypt.

Column (6) of Table 6 presents an index of agricultural employment between 1964 and 1979. This index is constructed by dividing the total labor cost of crop production by the average nominal wage index for men [5]. Thus, it represents the movements in the actual daily employment in agriculture. Figures 5-8 show the graphs of the growth rates of similar employment indices constructed for each region using the extrapolated regional wages. Three-year averages of these growth rates are shown in Table 10. The number of people 'employed' in agriculture is also given in the last column of Table 6. This indicator is based on population censuses and labor force surveys (quoted from Hansen and Radwan, 1982, Table 70), and is likely to miss the year-to-year variations in the 'intensity' of employment in agriculture [6]. Below we will compare the properties and implications of this index with the new ones constructed in this paper.

Agricultural employment in Egypt as a whole has dropped since the late sixties (Table 6, column (6)). This is particularly true of the SDG, UG and ME regions. Only in Upper Egypt employment has gone up slightly during the 1970-1979 period (Table 10). Employment in the four regions went up in 1965, but remained almost constant until 1967. After a temporary sharp rise in 1968, it declined and was quite low by 1972 (see Figures 5-8). The situation improved in 1973 and 1974, but after 1975 agricultural employment fell continuously in most regions. Note that the apparently solid growth of employment in Urban Governorates is a clear exception to this, and may continue as the vegetable demand keeps rising in urban areas. Further note that Upper Egypt also shows a short-lived partial recovery in 1978.

Hansen and Radwan (1982, pp.154-157) use the number of people employed in agriculture and the wage rate deflated by the agricultural value added to show that labor demand in Egyptian agriculture is wage-elastic and that it can be regarded as a buffer to absorb the employment shocks in other sectors. However, our analysis points to a somewhat different direction. A close examination of the employment-wage relationship in Figures 5-8 shows that in almost all years before 1973 wage and employment have been moving almost together in all regions. Then beginning 1973, they started to move in opposite directions. It, thus, seems that before 1973 the agricultural sector faced a relatively stable labor-supply curve and employment fluctuations were along this schedule mainly as a result of shifts in the labor-demand curve. However, after 1973 the demand curve has remained more or less stable, while supply has begun to shift and to push wage and employment in opposite directions. Thus, if our observations are correct, the wage elasticities of the supply and demand curves in the labor market may be inferred from the relative wage-employment movements in the the two sub-periods. It is evident from Figures 5-8 that variations of wages have been much larger than those of the employment indicators and that wage response to employment changes have been quite strong. This obviously implies rather inelastic demand and supply curves. Note that the erratic variations of the wage rate in the mid-seventies points to a particularly inelastic labor demand in Egyptian agriculture. We therefore conclude that using the agricultural sector as an employment buffer may imply large variations in the wage rate and consequently considerable changes in the distribution of income.

5. Factor Incomes and Factor Shares.

In this section, we study the main trends in factor incomes and factor shares. In the first five columns of Table 8, the nominal per feddan (=1.035 acres) values of labor costs, 'rent', 'profit', and their combinations are given. Indices of 'real' values of these variables, reported in the last five columns of the same tables, are formed by deflating them by the rural cost-of-living index. Table 9, on the other hand, presents the revenue shares of these factors and their combinations along with those of other (intermediate) inputs.

It is clear from Table 8 that the real labor income per feddan of (physical) agricultural land has been declining in the late sixties and early seventies in all four regions. However, it has made a strong recovery during the second half of the seventies. Labor share in the total value of agricultural output, reported in Table 9, has also moved parallel to the absolute labor income: it fell to its lowest level in 1971-1973 and went up quickly in 1977-1979 [7]. It is interesting to note that the trend in the labor share is highly correlated with the trend in the agricultural real wage rate. This observation clearly suggests a low substitutability between labor and other agricultural inputs and provides further evidence for the low elasticity of labor demand in Egyptian agriculture hypothesized in the previous section.

The 'rent' category in Tables 8 and 9 refers to the 'official' rent and does not truly reflect the 'market' price of land in Egypt. Note that nominal rents remain essentially constant until 1975, after

which, following the spirit of the 'open door' policy, the rent controls may have weakened. Also note that average nominal rents are close to each other in the four regions, despite the large differences in land fertility and profitability. In any case, the 'official' rent data may be of interest for understanding the situation of landlords who could not bypass the rent controls legally and make special arrangements with their tenants. The real income and the output share of these 'absentee' landlords has declined more or less continuously throughout the period under consideration.

'Profit' in Tables 8 and 9 is calculated as the residual of gross revenue over the total cost of factor and non-factor intermediate inputs plus 'rent.' However, since 'rent' does not reflect the returns to land, the 'profit' which is calculated in this manner includes part of the marginal productivity of land as well as the returns to infrastructure, management, and the like. An interesting way to interpret the 'profit' category is to consider it as the income of a capitalist tenant who has rented in a piece of land at official rates and is exclusively dependent on wage labor for his production. The income of such tenants should, thus, largely depend on the real agricultural wage. Indeed, we find that as crop prices fell and wages rose in the late sixties, real 'profit' declined, but it went up rapidly around 1973 with the deterioration of the real wage rate, and then declined after 1975. Towards the end of the seventies 'profits' were increasing again, but in 1979 a large wage hike cut them sharply. The share of 'profit' in total crop revenue has also had a similar behavior peaking around 1974.

If one is interested in the total returns to land, or the income of capitalist farmers who own the land under their operation, one has to look at the 'rent plus profit' category. Since 'profit' has a large share in total revenue and fluctuates rather strongly, it dominates the 'rent plus profit' indices. Therefore, like 'profit', total profitability of land has had peaks in 1967, 1974, and 1978. Note that the strong negative correlation of revenue shares of total returns to land with those of labor confirm our view of the specificity of labor in Egyptian agriculture and point to important wage-profit trade-offs.

Finally, we turn to the indicators of income of farmers who cultivate their own land (mainly small farmers). These indicators are the returns to, and the share of, 'labor plus rent plus profit.' The movements in 'profit' indices again more or less dominate these indicators for the most part. The real income of the owner-operated farms seems to have deteriorated in the late sixties, with some signs of improvement becoming apparent only in the second half of the seventies.

One of the interesting aspects of Tables 8 and 9 is the inter-regional differences in terms of factor incomes and factor shares. In this respect, several points are in order. First, note that in the mid-sixties nominal income of labor per feddan of agricultural land has been the highest in the SDG region and lowest in UE, while towards the end of the seventies the situation becomes quite the opposite. The reason must be due to the fact that agricultural real wages have been rising most rapidly in UE and most slowly in SDG (Table 7). If

one notes that the revenue share of labor has also grown most dramati-
cally in Upper Egypt and has actually declined in SDG (Table 9), one
can find yet another observation confirming the hypothesis of the spe-
cificity of labor in agricultural production in Egypt. However, this
time the evidence is cross-sectional.

Nominal 'rent plus profit' and its share in total revenue have
been quite high in the Urban Governorates. It is also relatively high
in the SDG region, and seems to decline towards the south--i.e. ME and
UE. Thus, the pattern of land profitability found here agrees with
the common conceptions that land in Upper Egypt is less fertile and
that proximity to larger cities enhances agricultural profitability.

Note that regional differences slightly diminish when total factor
incomes--i.e. 'labor' plus 'rent' plus 'profit'--are compared. The
share of this category in total crop revenue turns out to be the
highest in the UG and ME regions, and lowest in SDG and UE regions.

Table 9 shows that between sixties and seventies, profitability of
land, i.e., 'rent plus profit,' in terms of consumption goods or in
terms of its share in total product has increased in all regions. This
is interesting since according to Table 3 aggregate growth rates have
fallen everywhere except in ME. Moreover, we find that the increase in
profitability has been largest in the SDG region where average output
growth rate has dropped most, and it has been smallest (and practically
negligible) in ME where average growth has actually increased in the
seventies. Thus, both time series and cross-sectional evidence indi-
cate that the factors which increase aggregate growth rate tend to
reduce the revenue share of land and to increase the shares of labor

and other inputs. Therefore, these factors must be augmenting land in
production system which allows little substitution among different
inputs.

6. Non-Factor Inputs and Technical Change.

Table 9 gives the shares of different inputs in the total crop
production of the four regions. By deducting the last column of this
table--the share of labor, 'rent', and 'profit'--from 100, one can
find the share of non-factor inputs in the total revenue, which turns
out to be between 20 to 35 percent. This share rose from 1965-1967
to 1968-1970; then it declined until the mid-seventies, and rose again
later in all regions with the exception of the SDG. The main com-
ponents of the 1971-1976 decline in the share of non-factor inputs
seem to be the diminishing shares of animal power and of fertilizer.
The small share of insecticides has also been decreasing somewhat in
all regions. In fact, mechanical power and seeds are the only com-
ponents among non-factor agricultural inputs which had a rising share
in some areas in the seventies. Manure seems to have kept its share
more or less constant in all regions.

In Table 10, we have compiled the average growth rates of agri-
cultural inputs in the four regions. Since we had the nominal costs
of each input category, we needed input-price indices in order to
calculate indices of input volumes. However, only the wage rate and
the price of fertilizer were available, and we had to come up with
appropriate proxies for other input prices. Since the price of using
animals in production is essentially their feeding costs, we assumed
that revenue per feddan of berseem--the major feed crop in Egypt--is a

good proxy for the price of animal power [8]. We have deflated the costs of mechanical power and manure by the rate of inflation using the rural consumer price index as a proxy. Furthermore, we have assumed that nominal prices of insecticides have remained constant and that the prices of seeds are equal to the lagged prices of crops themselves.

According to Table 10, in the 1971-1979 period, uses of human and animal labor have been declining in all regions except in Upper Egypt, while uses of mechanical power, manure, and fertilizer have clearly expanded [9]. As we have seen in Section 4, reduction in employment seems to have been a response to the wage hikes following the supply shocks of mid- and late-seventies. Animal unit costs have also risen sharply during the same period, but unlike labor, animal power has lost its share in total revenue, implying greater substitutability of animals with other inputs in crop production and, thus, a rather elastic demand for animal power. If this argument is correct, a case can be made for the hypothesis put forward by deJanvry and Subarrao (1983) claiming that in the seventies mechanization of Egyptian agriculture has mainly displaced animal power and not human labor which has proven to be a more specific factor.

One expects mechanization to advance earlier and faster in areas near urban centers. However, assuming that the level of mechanization can be measured by the share of mechanical power in the total value of output, in Table 9 we surprisingly find that the Urban Governorates have been less mechanized than all other regions in Egypt, and that their mechanization process has started rather late. Upper Egypt, on

the other hand, has used relatively more mechanical power, more fer-

tilizer and less manure than other regions. It is also noteworthy

that mechanization has had the slowest pace in Upper Egypt, suggesting

that there has been a tendency for homogenization of the four regions.

Before we attend the aggregate input measures, two more points

need to be clarified. The first point is about the apparent paradox

of the rapid growth of fertilizer input and a simultaneous decline in

its revenue share. This is, of course, the manifestation of

fertilizer price controls: prices of almost all types of fertilizer

have remained fixed in nominal terms since 1964 (Cuddihy, 1980, Table

V.1). This phenomenon also reappears in case of insecticides, which

are by and large controlled and applied by government agencies. The

second point concerns the increasing share of seeds in the total agri-

cultural revenue of all regions except SDG. This either reflects an

improvement in the seed quality, or, perhaps, the increasing use of

monopoly power by the government over the distribution of seeds of

certain crops such as cotton.

The last column of Table 10 presents the three-year average growth

rates of the aggregate input volume index. All inputs listed in Table

10 are included in this index except insecticides which are considered

to be fixed costs. We have also calculated the corresponding aggregate

Tornqvist-Theil price index for these inputs. Three-year moving

averages of aggregate real price and volume indices of inputs are pic-

tured in Figures 1-4.

The first noticeable point about input and output graphs in

Figures 1-4 is that they are not as highly correlated as one expects

them to be. The reason of course lies in the fact that changes in weather and in infrastructure are not captured in our aggregate input index. In Egypt, a large part of variation in agricultural output is due to availability of water and proper drainage facilities which are not under farmers' control. We will come back to issue of infrastructure below.

The second point about the relationship between aggregate input and output indices is that to the extent that they are correlated, the former has clearly greater variations than the latter. This observation underscores the scarcity of land in Egyptian agriculture and the operation of the law of diminishing returns to variable inputs.

Finally, it is important to note that aggregate volume and real price indices of inputs both move pro-cyclically. This seems to be a situation of stable aggregate input supply with demand shifting up and down. Therefore, the source of variations of aggregate agricultural output in Egypt cannot be the relative price movements, as is usually claimed to be the case. Relative prices certainly play a role in production decisions, but in this case their effects seem to be far outweighted by some other factors which drive the level of activity and move relative prices accordingly. As we will argue below, these other factors are likely to be among the components of government-provided infrastructure.

7. Investment and Infrastructure.

The main components of agricultural infrastructure in Egypt are arable land, irrigation and drainage systems, and research institutions for the improvement of crop varieties. As a tradition, and

probably for economic and social reasons, most of these elements have been developed by the government. Particularly in the last two decades, private investment has constituted only a very small proportion of the total investment in Egyptian agriculture.

In Table 11 we have been able to distinguish two types of agricultural investment: irrigation and drainage on the one hand, and land reclamation, etc., on the other hand. The irrigation and drainage category includes investment in the Aswan High Dam except the part which is related to power generation. In the 'other' category, land reclamation constitutes the bulk of investment. Unfortunately, we have not been able to find a separate time-series for investment in agricultural research in Egypt.

Several important observations can be made with respect to the two types of investment shown in Table 11. The most important one is that real investment in irrigation and drainage was cut into half between 1969 and 1971. This was partly due to the completion of the High Dam in 1970, and partly due to the shortage of foreign exchange between the two wars with Israel. However, although total investment in the economy as a whole dwindled in the early seventies, the continuously falling share of agriculture makes it clear that there must have been a deliberate government policy to reduce investment in agriculture. According to Table 11, the share of agriculture in total national investment has dropped from about 20 percent in 1965 to about 6 percent in 1975. Thereafter the decline of the share has leveled off just above 7 percent. Note that actual real investment in agriculture has increased rapidly in 1977 and 1978. This is a reflection of the eased foreign exchange situation and the subsequent investment boom in Egypt.

The next observation concerns the differences in the trends of the two types of agricultural investment. Note that the drop in real investment during the early seventies is much stronger and has a slower recovery for irrigation and drainage than for the 'other' category. Indeed, the level of 'other' investment in 1975 is almost the same as it is in 1965, while the volume of irrigation and drainage investment stands about 40 percent below its 1965 level. These facts are indications of the priority of land reclamation in the investment decisions of the government; a policy which has received much criticism from all quarters. Several field studies and econometric works have found land-reclamation projects detrimental to Egyptian agriculture, but the desire to expand the land base of the sector has provided the government with enough momentum to proceed with its own policies anyway [10].

Finally, note that the period of reduced investment in agriculture coincides, with a short lag, with the slow down of growth of agricultural production in Egypt, particularly in the Delta region (i.e., SDG and UG). This is hardly surprising, since most of investment activities have concentrated in the Delta (Waterbury, 1979). In order to demonstrate the relationship between production and investment in agriculture more emphatically, we have constructed an index of infrastructural 'capital stock' by using the investment data in Table 11 and by assuming an initial growth rate of 3 percent in 1965 and a depreciation rate of 5 percent per year [11]. In Figure 9, we have superimposed the three-year moving averages of this index on those of the aggregate country-wide volume of output. The parallel movements of the two curves in the seventies is quite remarkable. The

negative and low growth rates of output around 1967 may of course be explained by the repercussions of the Six-Day War.

8. Conclusion.

In this paper we have examined various indices of aggregate behavior of four agricultural regions in Egypt. We have found that in the seventies, the aggregate growth of crop production has slowed down in most of these regions. Only the Urban Governorates seem to have grown rather vigorously in the second half of the seventies. The Six Delta Governorates also show some signs of recovery towards the end of the decade.

We have also found that aggregate real input prices (aggregate input prices deflated by output prices) have been moving pro-cyclically. However, there is greater similarity among the real input price paths of the four regions than among their aggregate output paths. These time-series and cross-sectional observations imply that input prices have been indeed moving along their more or less stable supply schedules, and that aggregate production is not price sensitive. Output, therefore, must have been essentially determined by other factors. A plausible factor which may explain a great deal of the main trends in aggregate production is investment in agricultural infrastructure. However, the impacts of this factor are more evident in the Delta than in the Nile Valley.

Total returns to land, including returns to intrastructure, claim about 45 to 65 percent of total crop revenue. This reflects the significance of the contribution of this factor to production. Therefore, expansion of production is very much dependent on the extent to which

land can be vertically or horizontally augmented. We have also seen that the share of land has a clear trade-off with the share of labor, both through time and across regions. It is particularly evident that when investment in infrastructure falls, the share of land soars and that of labor declines. Thus, land augmentation projects not only determine the aggregate output, but they also have profound impacts on income distribution; a point that should not be overlooked in agricultural policy analysis.

A major technical change in Egyptian agriculture in the last two decades has been rapid replacement of animal power by mechanical power in most regions. However, in the seventies mechanical power has been losing its share to animal power in Upper Egypt where the use of machinery in production has been far more advanced than other regions. Although this implies a process of homogenization of the sector as a whole, it may also point to the limits to mechanization of Egyptian agriculture in the near future.

Demand for animal power, due to its apparent substitutability with mechanical power, seems rather responsive to the prices of feed crops. However, demand for labor is less elastic. Evidence supporting this claim has been provided by the large responses of the real wage rate to the shifts in the agricultural labor supply after 1973 and by the wage differentials across Egypt. In Upper Egypt, where unlike other regions employment has increased somewhat in the seventies, real wages have been rising faster than the rest of the country and the share of labor has also expanded more rapidly. This finding has far reaching

implications for policies towards income distribution in the agri-
cultural sector. It particularly shows that using agriculture as an
absorbent of employment shocks in the rest of the economy—suggested
by Hansen and Radwan (1982)—may lead to significant changes in income
distribution, unless this policy is coordinated with appropriate
changes in public investment and perhaps in other sectoral measures.

Notes.

[1] Animal products, some vegetables, and all fruits are excluded from the analysis due to lack of data. The effects of these omissions will be explained below.

[2] The agriculture of Tahrir governorate is solely based on the newly reclaimed land and produces only a small amount of cotton. It had to be included in one of the four regions, and we decided to put it in the UG. However, the production in Tahrir is so small that, practically speaking, it does not make any difference to which region it is added.

[3] Note that output-price movements have been somewhat different in different regions and it may be inappropriate to compare them with the country-wide index of rural cost of living. Unfortunately, regional cost-of-living indices are not available at the present time. Regional differences may be important in this respect, since in the late seventies aggregate crop price inflation seems to have accelerated rapidly in Middle and Upper Egypt, while it has remained close to its mid-seventies level in the other two regions.

[4] The model used for this extrapolation is: (regional wage) = a + b (country-wide average wage), where a and b are constant coefficients.

[5] Total labor cost includes both costs of hired and (imputed) family labor. Cost of labor in the Ministry of Agriculture data base is not broken down into male, female, or child labor categories. However, as long as the wage rates for these types of labor move together, our employment index will measure the 'male-equivalent' of all types of labor. Indeed, very close relationships have been observed in the agricultural labor market among the wage rates of men, women, and children in the past two decades (see Mohie-Eldin, 1982).

[6] Labor Force Surveys are carried out during the month of June which is a peak season in Egyptian agriculture. This data may not reflect any variations in employment in the rest of the year. It also does not measure the variations in female labor force which is usually highly underestimated in surveys and censuses.

[7] Labor shares given in Table 9 may seem rather low, especially when compared with the estimates of other studies of Egyptian agriculture such as Hansen(1968) and Mohie-Eldin(1982). However, as we have argued in Esfahani(1984), the discrepancy may be explained by the facts that we have excluded animal production from our indices and that labor income in other studies is based on the number of people employed in agriculture

times the average wage rate, assuming full-employment. Note
that while 'full-employment' in rural Egypt is a valid assump-
tion, not all employment can be attributed to agriculture.

[8]   Separate data for price and yield of berseem is not available.

[9]   Note, that mechanical power use starts from a very limited base
      in the mid-sixties and even small changes in its absolute value
      give rise to erratic growth rates.

[10] For a discussion on this point see Ikram (1980). For an example
      of econometric work see Esfahani (1984).

[11] The shape of the resulting curve and its correlation with produc-
      tion behavior is not sensitive to these assumptions.

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TABLE 1

AVERAGE SHARES OF CROPS IN THE TOTAL VALUE
OF AGRICULTURAL PRODUCTS IN THE FOUR REGIONS
(percentages)

CROPS \ YEARS	SIX DELTA GOVERNORATES			URBAN GOVERNORATES			MIDDLE EGYPT			UPPER EGYPT		
	65-69	70-74	75-79	65-69	70-74	75-79	65-69	70-74	75-79	65-69	70-74	75-79
BARLEY	0.71	0.65	0.71	0.66	0.57	0.70	0.33	0.26	0.45	0.90	0.35	0.50
BEANS	1.45	0.88	0.96	0.96	0.55	0.35	6.23	6.98	5.95	4.70	3.67	4.02
BERSEEM,LONG	18.81	18.13	21.15	20.70	23.06	26.96	13.65	12.75	19.00	7.80	8.17	8.91
BERSEEM,SHORT	8.17	7.18	7.10	6.60	6.70	5.25	7.44	5.50	5.84	7.05	4.02	3.31
COTTON	25.88	24.58	20.94	17.17	13.64	8.59	31.07	27.27	16.88	19.40	17.13	11.34
FLAX	0.21	0.30	0.52	0.17	0.15	0.14	0.01	0.04	0.08	0.00	0.00	0.00
GROUNDNUTS	0.27	0.13	0.18	1.36	1.19	1.53	0.96	0.38	0.08	0.48	0.28	0.27
LENTILS	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.02	0.02	3.16	3.77	1.72
MAIZE,SUMMER	9.30	10.30	9.10	21.13	20.52	18.14	8.13	10.77	13.41	3.04	4.15	6.50
MAIZE,NILI	1.09	0.96	1.42	1.55	1.10	2.30	8.44	6.90	7.08	2.20	2.02	2.20
ONIONS	0.03	0.04	0.09	0.22	0.12	0.14	0.96	0.50	0.70	2.51	2.49	1.66
POTATOES,NILI	0.60	0.90	1.39	1.88	3.35	6.43	0.49	0.69	0.96	0.01	0.07	0.20
POTATOES,SUMMER	0.88	1.24	2.20	1.52	2.25	4.61	0.14	0.34	0.59	0.00	0.01	0.02
RICE	18.66	16.57	16.46	1.49	1.10	0.65	0.83	0.83	0.79	0.00	0.01	0.00
SESAME	0.06	0.01	0.00	0.46	0.26	0.14	0.13	0.20	0.08	0.65	1.51	1.17
SORGHUM	0.00	0.00	0.00	1.00	0.73	0.31	3.14	3.48	1.91	17.23	17.01	13.47
SUGAR CANE	0.10	0.13	0.23	0.32	0.44	0.68	2.15	2.58	5.15	12.54	15.78	23.27
TOMATOES,NILI	1.86	3.96	2.83	3.20	4.95	3.38	2.48	5.01	4.79	0.66	1.23	0.94
TOMATOES,SUMMER	2.25	2.38	2.60	4.00	3.87	5.01	1.12	1.24	1.19	0.41	0.38	0.49
TOMATOES,WINTER	1.45	1.99	2.59	5.75	5.82	6.15	2.18	3.50	4.75	1.74	2.04	3.29
WHEAT	8.24	9.68	9.53	9.88	9.64	8.55	10.10	10.76	10.27	15.53	15.90	16.72
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Computed from Ministry of Agriculture data.

TABLE 2
AVERAGE SHARES OF THE FOUR REGIONS
IN THE TOTAL VALUE OF AGRICULTURAL OUTPUT IN EGYPT: 1965-1979

YEARS	ALL EGYPT	SIX DELTA GOVERNORATES	URBAN GOVERNORATES	MIDDLE EGYPT	UPPER EGYPT
65-67	100.00	49.55	15.89	17.38	17.19
68-70	100.00	52.95	15.39	15.38	16.28
71-73	100.00	52.10	15.52	14.98	17.39
74-76	100.00	51.46	15.61	15.14	17.79
77-79	100.00	52.75	16.21	14.78	16.26

Source: Calculated from Ministry of Agriculture data.

TABLE 3
AGRICULTURAL GROWTH RATES
IN EGYPT: 1965-1979

YEARS	ALL EGYPT	SIX DELTA GOVERNORATES	URBAN GOVERNORATES	MIDDLE EGYPT	UPPER EGYPT
65-67	-0.93	-1.55	-0.78	-0.02	-0.52
68-70	4.69	6.60	3.69	0.55	3.23
71-73	1.01	0.88	-1.72	-0.29	5.15
74-76	1.11	0.35	3.13	3.41	-0.58
77-79	1.42	2.38	2.47	-0.13	-1.59
65-70	1.88	2.53	1.46	0.27	1.36
71-79	1.18	1.20	1.29	1.00	0.99

Source: Calculated from Table A.4.

TABLE 4
GROWTH RATES OF PRICES IN RURAL EGYPT: 1965-1979
(Wages, Cost of Living, and Aggregate Farm-Gate Crop Prices)

YEARS	AVERAGE AGRICULTURAL WAGE RATE	COST OF LIVING INDEX	AGGREGATE OUTPUT PRICES				
			ALL EGYPT	SIX DELTA GOVERNORATES	URBAN GOVERNORATES	MIDDLE EGYPT	UPPER EGYPT
65-67	6.39	-4.01	5.74	5.90	7.39	4.34	5.13
68-70	0.00	6.15	-2.72	-2.34	-3.91	-2.92	-2.76
71-73	5.18	4.59	8.64	7.14	12.07	8.87	9.48
74-76	24.83	11.98	11.13	12.40	10.64	8.37	9.95
77-79	18.15	9.66	13.23	11.97	12.11	16.70	15.13

Sources: Calculated from Table 6 and Table A.5.

TABLE 5

AVERAGE GROWTH RATES OF OUTPUTS AND FARM-GATE PRICES
OF EGYPTIAN CROPS: 1965-1979[1]

CROPS \ YEARS	OUTPUT					PRICE				
	65-67	68-70	71-73	74-76	77-79	65-67	68-70	71-73	74-76	77-79
BARLEY	-11.64	-6.00	4.69	8.39	-0.40	4.26	-3.11	4.05	10.62	11.17
BEANS	-22.18	12.99	-0.58	-2.31	-2.54	4.50	-6.70	4.55	21.30	11.02
BERSEEM,LONG[2]	7.48	1.02	1.50	2.43	0.68	0.70	-8.23	16.03	9.37	15.86
BERSEEM,SHORT[2]	-1.57	-0.39	1.50	-6.83	-0.47	0.49	-8.45	16.69	8.06	16.27
COTTON	-5.78	5.02	-0.87	-7.75	5.73	0.68	2.07	2.70	16.43	12.76
FLAX	-14.26	1.74	23.07	7.42	11.83	4.64	3.41	9.04	11.18	12.51
GROUNDNUTS	-12.26	6.01	-13.02	3.17	-1.82	15.41	-2.10	1.93	22.03	14.91
LENTILS	-14.52	-0.75	20.65	-16.19	-47.57	13.38	1.99	2.15	10.32	17.40
MAIZE,SUMMER	35.59	4.20	2.50	5.82	-2.42	11.15	-3.40	11.32	3.62	14.73
MAIZE,NILI	-39.35	-0.37	-3.57	10.14	4.53	9.69	-3.57	13.03	2.77	15.35
ONIONS	-8.17	-7.44	0.41	1.38	-14.14	6.65	3.37	10.36	14.17	14.00
POTATOES,NILI	-14.24	28.11	12.50	5.83	-0.85	19.75	-8.50	3.72	31.11	7.88
POTATOES,SUMMER	-6.29	17.38	12.43	1.40	10.04	11.05	-0.10	2.68	33.79	4.59
RICE	3.82	4.44	-4.51	0.34	2.94	12.74	-1.96	2.16	18.82	9.96
SESAME	-37.98	33.02	2.07	-16.61	-0.96	10.20	1.84	2.65	14.39	25.09
SORGHUM	6.99	-0.02	-0.45	-4.53	-4.97	9.34	-1.43	12.36	4.34	12.02
SUGAR CANE	2.43	9.20	1.89	4.64	1.33	6.61	0.52	8.65	26.96	13.44
TOMATOES,NILI	1.58	7.53	8.15	1.03	-4.26	3.56	7.13	21.94	3.39	2.81
TOMATOES,SUMMER	10.60	-0.09	-0.21	12.91	8.56	9.13	0.79	9.88	-1.63	20.11
TOMATOES,WINTER	-12.58	19.29	-10.61	16.90	10.96	32.37	-20.51	24.01	3.54	-2.67
WHEAT	-4.87	5.40	6.39	2.16	-1.83	9.77	2.26	-0.98	8.42	17.23
AVERAGE AGRIC. WAGE RATE	-	-	-	-	-	6.39	0.00	5.18	24.83	18.15
COST OF LIVING INDEX	-	-	-	-	-	-4.01	6.15	4.59	11.98	9.66
PRICE OF BEEF	-	-	-	-	-	3.98	5.12	4.74	16.91	10.16
PRICE OF MILK	-	-	-	-	-	12.97	-4.70	7.88	16.76	13.46

[1] Weighted averages of prices of primary and secondary products.
[2] Instead of output and price of berseem, its area and revenue per feddan are used.
  Data on price and yield of berseem is available only for 1978 and 1979.

Source: Computed from Ministry of Agriculture data. For cost of living index see Table 6.

TABLE 6
WAGES AND EMPLOYMENT IN EGYPTIAN AGRICULTURE: 1964-1979

YEAR	AVERAGE AGRICULTURAL WAGE RATE (PT PER DAY) (1)	COST OF LIVING INDEX (1964=100) (2)	REAL CONSUMPTION WAGE INDEX (1964=100) (3):(1)/(2)	AGGREGATE OUTPUT PRICE INDEX (1964=100) (4)	REAL PRODUCT WAGE INDEX (1964=100) (5):(1)/(3)	AGRICULTURAL EMPLOYMENT INDEX (1964=100) (6)	NUMBER OF PEOPLE EMPLOYED IN AGRICULTURE ('000) (7)
1964	19.0	100.0	100.0	100.0	100.0	100.0	n.a.
1965	22.0	118.5	97.7	105.1	110.2	111.9	n.a.
1966	25.0	106.9	123.1	116.0	113.4	110.8	4300
1967	25.0	109.4	120.3	118.8	110.8	111.4	n.a.
1968	24.0	113.9	110.9	102.8	122.9	119.4	4781
1969	25.0	122.4	107.5	106.2	124.0	114.6	n.a.
1970	25.0	131.5	100.0	109.5	120.2	111.5	n.a.
1971	25.5	132.5	101.3	111.1	120.8	109.5	5085
1972	27.5	139.9	103.4	122.1	118.5	98.1	5294
1973	29.2	150.9	101.8	141.9	108.3	102.5	5005
1974	32.2	171.9	98.6	174.5	97.1	112.3	4776
1975	46.5	192.9	126.9	177.5	137.9	104.4	5033
1976	61.5	216.2	149.7	198.2	163.4	98.3	4900
1977	76.4	237.2	169.5	243.9	164.9	95.2	4767
1978	88.5	273.7	170.2	300.0	155.3	98.0	4523
1979	106.0	289.0	193.1	294.7	189.3	96.9	n.a.

n.a. Not Available.
Sources: Cost of living index: Central Agency for Public Mobilization and Statistics (CAPMAS).
Number of people employed in agriculture: Hansen and Radwan(1980, Table 70);
Others: computed from Ministry of Agriculture data.

TABLE 7
AVERAGE AGRICULTURAL WAGE RATES IN THE FOUR REGIONS IN EGYPT: 1968-1978

YEARS	SIX DELTA GOVERNORATES		URBAN GOVERNORATES		MIDDLE EGYPT		UPPER EGYPT	
	NOMINAL (PT/DAY)	REAL INDEX	NOMINAL (PT/DAY)	REAL INDEX	NOMINAL (PT/DAY)	REAL INDEX	NOMINAL (PT/DAY)	REAL INDEX
1968	23.4	100.0	25.1	100.0	19.2	100.0	24.9	100.0
1969	24.8	104.0	28.6	111.3	21.8	102.9	24.5	96.6
1970	25.2	101.7	28.8	107.9	20.8	97.5	24.8	95.6
1971	24.6	97.6	30.6	103.7	20.4	101.0	24.2	94.4
1972	25.4	94.5	32.4	100.0	21.0	85.9	25.0	88.4
1973	27.6	89.9	34.4	89.7	22.0	79.0	29.2	84.7
1974	32.4	86.1	39.5	85.0	26.7	76.7	41.4	96.9
1975	40.8	106.2	56.6	120.0	39.4	114.3	53.2	121.0
1976	54.5	122.4	70.3	133.2	50.7	141.7	70.4	151.5
1977	70.5	129.5	84.8	138.2	64.6	133.5	84.5	148.8
1978	90.6	122.2	103.5	127.4	76.2	128.8	91.6	133.9

Source: Calculated from Ministry of Agriculture data.
Governorate employment shares are used for regional aggregation.
Real wage indices are formed by deflating nominal wages by the
aggregate agricultural output price index for each region.

TABLE 8
MEASURES OF NOMINAL AND REAL PROFITABILITY OF LAND IN THE FOUR REGIONS: 1964-1979

(a) SIX DELTA GOVERNORATES

	NOMINAL (LE PER FEDDAN)					REAL INDICES (1964=100)*				
YEAR	LABOR	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT	LABOR	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT
1964	15.80	25.09	39.19	64.28	80.08	100.00	100.00	100.00	100.00	100.00
1965	20.56	26.71	30.87	57.57	78.14	109.86	89.83	66.48	75.59	82.35
1966	22.33	27.06	33.42	60.48	82.81	132.28	100.89	79.80	88.03	96.76
1967	22.71	26.66	35.36	62.02	84.73	131.45	97.16	82.51	88.22	96.75
1968	22.13	26.73	27.19	53.92	76.05	123.01	93.57	60.94	73.67	83.41
1969	21.95	27.48	35.48	62.95	84.91	113.55	89.47	73.96	80.01	86.63
1960	21.01	27.79	41.54	69.33	90.34	101.12	84.20	80.60	82.01	85.78
1971	21.27	27.55	41.67	69.22	90.49	101.65	82.88	80.26	81.29	85.30
1972	20.13	28.03	54.49	82.52	102.65	91.07	79.83	99.36	91.74	91.61
1973	21.35	28.83	71.56	100.39	121.74	89.53	76.12	120.97	103.46	100.71
1974	24.53	30.54	91.92	122.45	146.98	90.31	70.79	136.42	110.81	106.76
1975	32.77	31.95	82.47	114.42	147.19	107.54	66.02	109.09	92.28	95.29
1976	40.32	36.22	98.64	134.86	175.18	118.05	66.76	116.40	97.02	101.17
1977	49.83	38.33	130.93	169.26	219.09	132.98	64.40	140.85	111.01	115.34
1978	55.21	40.68	183.49	224.17	279.38	127.68	59.23	171.07	127.42	127.47
1979	68.66	58.33	145.17	203.50	272.16	150.40	90.45	128.18	109.55	117.61

(b) URBAN GOVERNORATES

YEAR	LABOR	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT	LABOR	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT
1964	13.91	22.38	57.00	79.39	93.30	100.00	100.00	100.00	100.00	100.00
1965	18.58	26.87	58.77	85.64	104.23	112.76	101.33	87.02	91.05	94.29
1966	21.12	27.77	65.09	92.86	113.97	142.06	116.08	106.84	109.44	114.31
1967	20.89	28.30	68.00	96.30	117.19	137.34	115.62	109.08	110.92	114.86
1968	22.42	28.02	48.70	76.72	99.13	141.55	109.93	75.03	84.87	93.32
1969	22.23	28.89	53.96	82.85	105.08	130.57	105.44	77.35	85.27	92.02
1960	22.42	28.85	55.87	84.72	107.14	122.59	98.01	74.52	81.14	87.32
1971	22.96	29.29	72.30	101.59	124.56	124.64	98.79	95.75	96.61	100.79
1972	22.33	28.94	86.77	115.71	138.04	114.74	92.39	108.79	104.16	105.74
1973	24.30	29.60	105.94	135.54	159.84	115.73	87.62	123.12	113.11	113.50
1974	27.79	30.05	144.35	174.40	202.18	116.21	78.08	147.30	127.78	126.05
1975	33.64	32.85	131.23	164.07	197.72	125.39	76.07	119.35	107.15	109.87
1976	41.31	40.62	148.30	188.92	230.23	137.36	83.91	120.32	110.05	114.12
1977	52.38	45.31	164.64	209.95	262.33	158.75	85.33	121.77	111.49	118.54
1978	63.85	49.30	256.31	305.62	369.46	167.72	80.47	164.29	140.65	144.69
1979	78.25	76.36	192.11	268.47	346.72	194.68	118.04	116.62	117.02	128.60

* Nominal values deflated by the rural cost of living index.
Sources: Cost of living index: CAPMAS; others: computed from Ministry of Agriculture data.

TABLE 8 (Continued)

(c) MIDDLE EGYPT

| | NOMINAL (LE PER FEDDAN) | | | | | REAL INDICES (1964=100)* | | | | |
YEAR	LABOR	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT	LABOR	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT
1964	12.34	21.14	41.89	63.03	75.37	100.00	100.00	100.00	100.00	100.00
1965	17.39	22.01	41.93	63.94	81.33	119.00	87.87	84.48	85.62	91.08
1966	18.83	21.96	46.31	68.28	87.11	142.85	97.21	103.46	101.36	108.15
1967	19.34	22.00	45.70	67.70	87.04	143.32	95.18	99.76	98.22	105.61
1968	20.25	22.65	26.05	48.70	68.95	144.18	94.08	54.62	67.86	80.35
1969	19.27	23.04	36.72	59.76	79.02	127.60	89.04	71.62	77.46	85.67
1960	19.09	24.78	36.13	60.91	80.00	117.63	89.14	65.59	73.49	80.71
1971	18.06	23.35	35.39	58.74	76.80	110.50	83.38	63.79	70.36	76.93
1972	17.00	22.69	56.95	79.65	96.64	98.45	76.72	97.17	90.31	91.64
1973	19.64	22.74	61.66	84.40	104.04	105.45	71.26	97.52	88.71	91.45
1974	24.95	23.11	91.98	115.09	140.04	117.61	63.59	127.73	106.22	108.08
1975	35.44	24.80	74.38	99.17	134.62	148.94	60.82	92.05	81.57	92.60
1976	43.38	30.75	69.69	100.45	143.82	162.61	67.28	76.94	73.70	88.26
1977	50.92	31.78	90.07	121.85	172.68	173.67	63.38	90.65	81.50	96.59
1978	58.43	32.83	144.27	177.09	235.52	173.03	56.74	125.84	102.66	114.18
1979	68.48	50.73	112.63	163.36	231.84	192.07	83.04	93.05	89.69	106.45

(d) UPPER EGYPT

YEAR	LABOR	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT	LABOR	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT
1964	12.69	21.43	30.58	52.00	64.70	100.00	100.00	100.00	100.00	100.00
1965	16.54	22.17	31.65	53.81	70.35	109.97	87.31	87.35	87.33	91.77
1966	18.10	22.28	27.03	49.32	67.42	133.44	97.30	82.73	88.74	97.51
1967	18.09	22.11	30.81	52.92	71.01	130.36	94.35	92.14	93.05	100.37
1968	18.04	21.87	20.40	42.26	60.30	124.81	89.62	58.59	71.38	81.86
1969	19.66	22.95	19.82	42.76	62.43	126.58	87.50	52.95	67.19	78.84
1960	20.12	23.91	22.60	46.51	66.63	120.54	84.84	56.21	68.01	78.31
1971	19.71	22.25	28.27	50.51	70.22	117.24	78.38	69.79	73.33	81.94
1972	19.95	24.24	42.45	66.69	86.63	112.31	80.84	99.21	91.64	95.70
1973	23.78	24.40	70.98	95.38	119.16	124.13	75.42	153.80	121.51	122.02
1974	31.54	25.56	81.25	106.81	138.35	144.53	69.39	154.57	119.47	124.39
1975	41.36	25.42	72.47	97.89	139.25	168.93	61.50	122.87	97.59	111.58
1976	54.10	29.10	63.44	92.54	146.64	197.12	62.81	95.95	82.29	104.82
1977	61.70	32.57	83.58	116.14	177.85	204.95	64.07	115.24	94.15	115.89
1978	86.68	33.47	95.02	128.49	215.17	249.51	57.07	113.55	90.28	121.51
1979	91.07	48.72	89.60	138.32	229.39	248.30	78.68	101.40	92.04	122.69

* Nominal values deflated by the rural cost of living index.
Sources: Cost of living index: CAPMAS; others: computed from Ministry of Agriculture data.

TABLE 9
INPUT SHARES IN THE TOTAL CROP REVENUE IN THE FOUR REGIONS: 1965-1979
(THREE YEAR AVERAGES)

(a) SIX DELTA GOVERNORATES

YEARS	LABOR	ANIMAL POWER	MECHANICAL POWER	SEEDS	MANURE	FERTI- LIZER	INSECTI- CIDES	SUNDRIES	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT
65-67	19.21	10.13	0.37	4.66	3.43	5.96	2.62	0.87	23.59	29.17	52.76	71.97
68-70	18.34	7.33	3.94	5.36	3.59	6.82	1.67	0.87	23.05	29.02	52.07	70.41
71-73	14.72	5.02	5.32	4.56	3.25	6.12	1.80	0.84	19.78	38.60	58.38	73.10
74-76	15.50	4.08	5.65	4.13	3.36	4.95	1.32	1.34	15.82	43.85	59.67	75.17
77-79	17.36	3.70	5.33	4.51	3.00	3.89	1.25	1.36	13.71	45.88	59.59	76.96
65-70	18.78	8.73	2.16	5.01	3.51	6.39	2.15	0.87	23.32	29.10	52.42	71.19
71-79	15.86	4.27	5.43	4.40	3.20	4.99	1.46	1.18	16.44	42.78	59.21	75.08

(b) URBAN GOVERNORATES

YEARS	LABOR	ANIMAL POWER	MECHANICAL POWER	SEEDS	MANURE	FERTI- LIZER	INSECTI- CIDES	SUNDRIES	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT
65-67	14.30	5.97	0.21	3.57	3.86	4.97	1.34	0.88	19.61	45.28	64.89	79.19
68-70	16.23	5.43	2.07	4.10	4.46	6.24	1.27	1.17	20.74	38.29	59.03	75.26
71-73	13.10	3.74	2.12	3.78	4.11	5.32	1.04	0.97	16.56	49.27	65.83	78.93
74-76	13.02	3.27	2.42	4.23	3.58	4.36	0.83	0.95	13.14	54.20	67.34	80.36
77-79	15.60	3.26	3.28	5.97	3.51	3.48	1.01	1.11	13.72	49.04	62.76	78.37
65-70	15.27	5.70	1.14	3.84	4.16	5.61	1.31	1.03	20.18	41.79	61.96	77.23
71-79	13.91	3.42	2.61	4.66	3.73	4.39	0.96	1.01	14.47	50.84	65.31	79.22

(c) MIDDLE EGYPT

YEARS	LABOR	ANIMAL POWER	MECHANICAL POWER	SEEDS	MANURE	FERTI- LIZER	INSECTI- CIDES	SUNDRIES	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT
65-67	17.16	4.01	1.20	3.51	3.65	6.51	1.15	1.05	20.40	41.35	61.76	78.92
68-70	19.26	3.97	2.36	3.97	3.79	8.59	1.60	1.26	23.07	32.13	55.20	74.46
71-73	15.40	2.67	2.73	3.77	3.51	7.55	1.32	1.12	19.43	42.50	61.93	77.33
74-76	19.54	2.39	3.25	3.75	3.43	5.62	0.94	1.25	14.85	44.98	59.83	79.37
77-79	21.64	3.07	4.81	4.39	3.12	4.67	0.95	1.41	13.98	41.95	55.94	77.58
65-70	18.21	3.99	1.78	3.74	3.72	7.55	1.38	1.16	21.74	36.74	58.48	76.69
71-79	18.86	2.71	3.60	3.97	3.35	5.95	1.07	1.26	16.09	43.14	59.23	78.09

(d) UPPER EGYPT

YEARS	LABOR	ANIMAL POWER	MECHANICAL POWER	SEEDS	MANURE	FERTI- LIZER	INSECTI- CIDES	SUNDRIES	RENT	PROFIT	RENT+ PROFIT	LABOR+ RENT+ PROFIT
65-67	18.09	5.59	7.13	4.82	0.81	7.97	0.77	1.27	22.85	30.70	53.54	71.63
68-70	19.79	5.33	9.96	5.92	1.70	9.41	1.44	1.41	23.53	21.50	45.03	64.82
71-73	16.45	4.06	8.53	5.38	1.42	8.28	0.92	1.32	18.50	35.13	53.64	70.08
74-76	21.81	3.56	6.79	6.00	1.48	6.45	0.74	1.45	13.86	37.86	51.72	73.53
77-79	28.01	5.07	6.51	6.19	1.07	5.57	0.59	1.75	13.45	31.80	45.25	73.26
65-70	18.94	5.46	8.55	5.37	1.26	8.69	1.11	1.34	23.19	26.10	49.29	68.23
71-79	22.09	4.23	7.28	5.86	1.32	6.77	0.75	1.51	15.27	34.93	50.20	72.29

Source: Computed from the Ministry of Agriculture data.

(a) SIX DELTA GOVERNORATES:

YEARS	LABOR	ANIMAL POWER	MECHANICAL POWER	SEEDS	MANURE	FERTILIZER	INSECTI-CIDES	AGGREGATE INPUT VOLUME
65-67	3.02	8.73	192.61*	0.01	8.48	15.67	1.16	7.32
68-70	-1.00	-7.88	70.55*	7.57	-5.43	5.30	7.52	5.17
71-73	-4.38	-15.64	-4.01	-0.69	2.20	3.09	-4.96	-3.97
74-76	-3.33	4.62	6.41	-1.26	4.15	4.99	9.58	0.95
77-79	-0.17	-3.36	0.18	-3.43	1.90	9.84	28.79	1.10
65-70	1.01	0.43	131.58	3.79	1.53	10.49	4.34	6.25
71-79	-2.62	-4.80	0.86	-1.79	2.75	5.98	11.14	-0.64

(b) URBAN GOVERNORATES:

YEARS	LABOR	ANIMAL POWER	MECHANICAL POWER	SEEDS	MANURE	FERTILIZER	INSECTI-CIDES	AGGREGATE INPUT VOLUME
65-67	3.24	7.15	129.27*	-7.59	-1.30	19.37	-8.23	5.01
68-70	3.33	0.56	54.38*	10.32	0.07	3.51	19.14	5.04
71-73	-3.52	-21.05	0.59	-0.23	1.80	3.76	-8.91	-3.60
74-76	-5.80	0.19	15.83	9.59	-1.79	5.55	12.40	1.06
77-79	3.41	8.70	6.09	0.12	7.14	8.47	35.50	5.48
65-70	3.29	3.86	91.83	1.37	-0.62	11.44	5.46	5.03
71-79	-1.97	-4.05	7.50	3.16	2.38	5.93	13.00	0.98

(c) MIDDLE EGYPT:

YEARS	LABOR	ANIMAL POWER	MECHANICAL POWER	SEEDS	MANURE	FERTILIZER	INSECTI-CIDES	AGGREGATE INPUT VOLUME
65-67	5.46	7.68	-14.23	-2.76	-0.62	11.13	-18.58	4.30
68-70	-2.35	4.66	26.43	2.18	-7.82	5.44	33.30	1.56
71-73	-2.02	-15.53	-1.39	-0.79	2.93	-0.45	-7.97	-2.48
74-76	1.46	10.74	17.13	8.00	3.47	5.77	6.23	4.87
77-79	-2.54	2.13	14.26	-5.37	.00	11.07	24.64	1.66
65-70	1.56	6.17	6.10	-0.29	-4.22	8.29	7.36	2.93
71-79	-1.03	-0.89	10.00	0.62	2.13	5.46	7.63	1.35

(d) UPPER EGYPT:

YEARS	LABOR	ANIMAL POWER	MECHANICAL POWER	SEEDS	MANURE	FERTILIZER	INSECTI-CIDES	AGGREGATE INPUT VOLUME
65-67	4.01	18.02	-7.84	-1.66	51.00	6.88	-4.31	3.68
68-70	2.81	9.51	8.21	7.11	11.60	7.14	29.42	6.06
71-73	1.21	-19.19	-11.18	1.63	-4.05	4.09	-9.05	-3.18
74-76	3.24	16.72	4.21	10.55	-6.47	6.41	8.66	6.10
77-79	-1.68	-1.94	2.09	-11.40	8.96	8.57	16.79	-1.02
65-70	3.41	13.77	0.19	2.73	31.30	7.01	12.56	4.87
71-79	0.92	-1.47	-1.63	0.26	-0.52	6.36	5.47	0.63

* Growth rate is unrealistically high due to negligible base levels.
Source: Calculated from Ministry of Agriculture data.

TABLE 11
AGRICULTURAL INVESTMENT IN EGYPT: 1965-1978

| | CURRENT PRICES* | | CONSTANT 1965 PRICES* | | PERCENT OF TOTAL INVESTMENT | |
| | DRAINAGE/ | | DRAINAGE/ | | DRAINAGE/ | |
YEAR	IRRIGATION	OTHER	IRRIGATION	OTHER	IRRIGATION	OTHER
1965	51.6	30.7	51.6	30.7	12.5	7.4
1966	50.9	31.1	47.5	29.1	12.2	7.5
1967	31.6	24.6	28.5	22.2	8.7	6.8
1968	42.0	25.6	37.6	22.9	12.7	7.8
1969	34.3	27.0	30.2	23.7	9.3	7.4
1970	25.4	27.9	20.2	22.2	6.0	6.5
1971	21.6	22.3	15.0	15.5	5.0	5.2
1972	22.0	28.3	16.1	20.7	5.3	6.8
1973	22.4	35.2	18.0	28.2	5.0	7.9
1974	21.5	32.7	17.5	26.6	2.9	4.5
1975	41.7	42.4	29.7	30.2	3.1	3.2
1976	99.4		64.3		7.1	
1977	139.0		72.6		7.3	
1978	179.0		82.9		7.5	

* Millions of LE. Investment at constant prices calculated by
  dividing nominal values by a price index for total investment.

Source: Computed from Ikram(1980, SA Table 9).

Figure 1. Six Delta Governorates
Aggregate Output, Input, and Prices
3-Year Moving Averages of Growth Rates
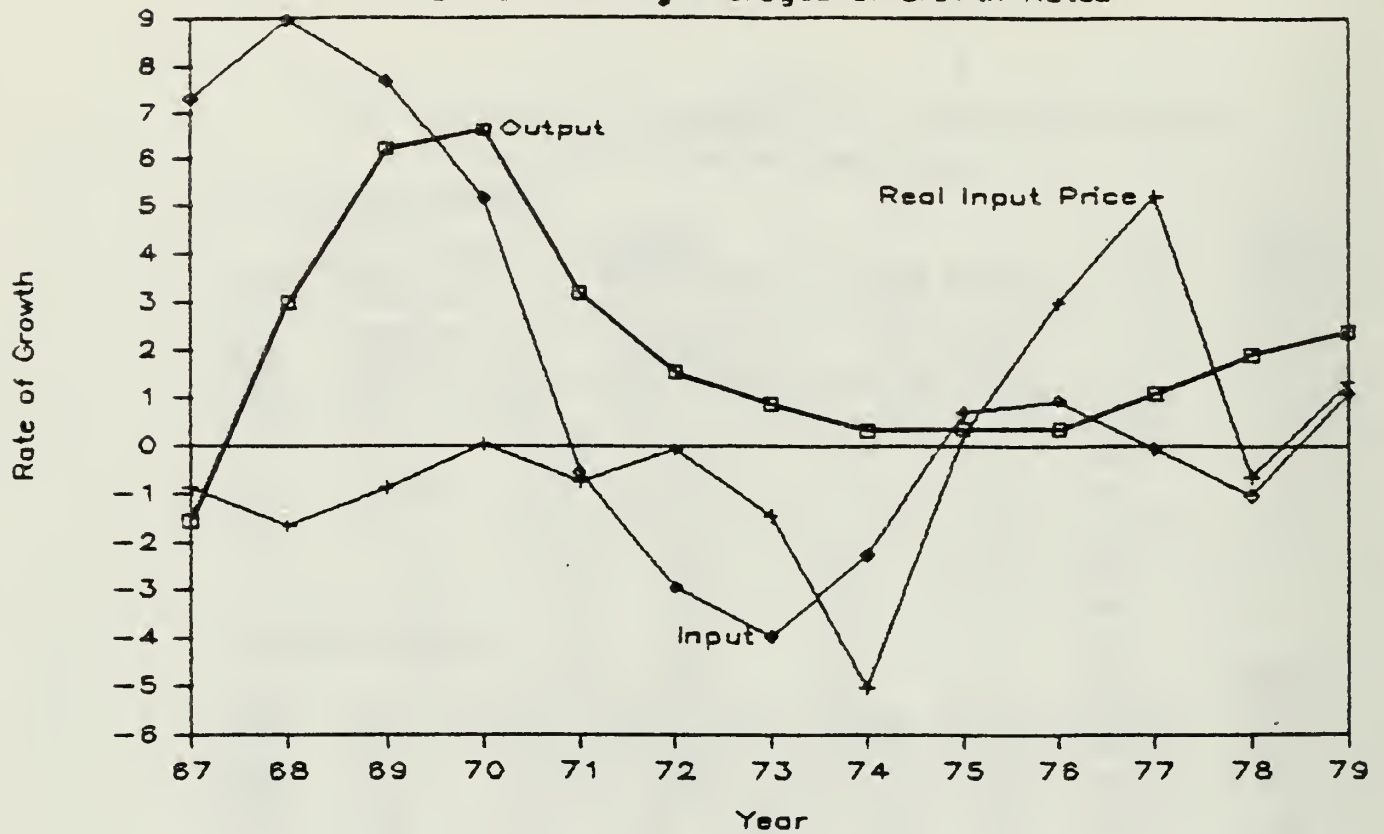
Figure 2. Urban Governorates
Aggregate Output, Input, and Prices
3-Year Moving Averages of Growth Rates
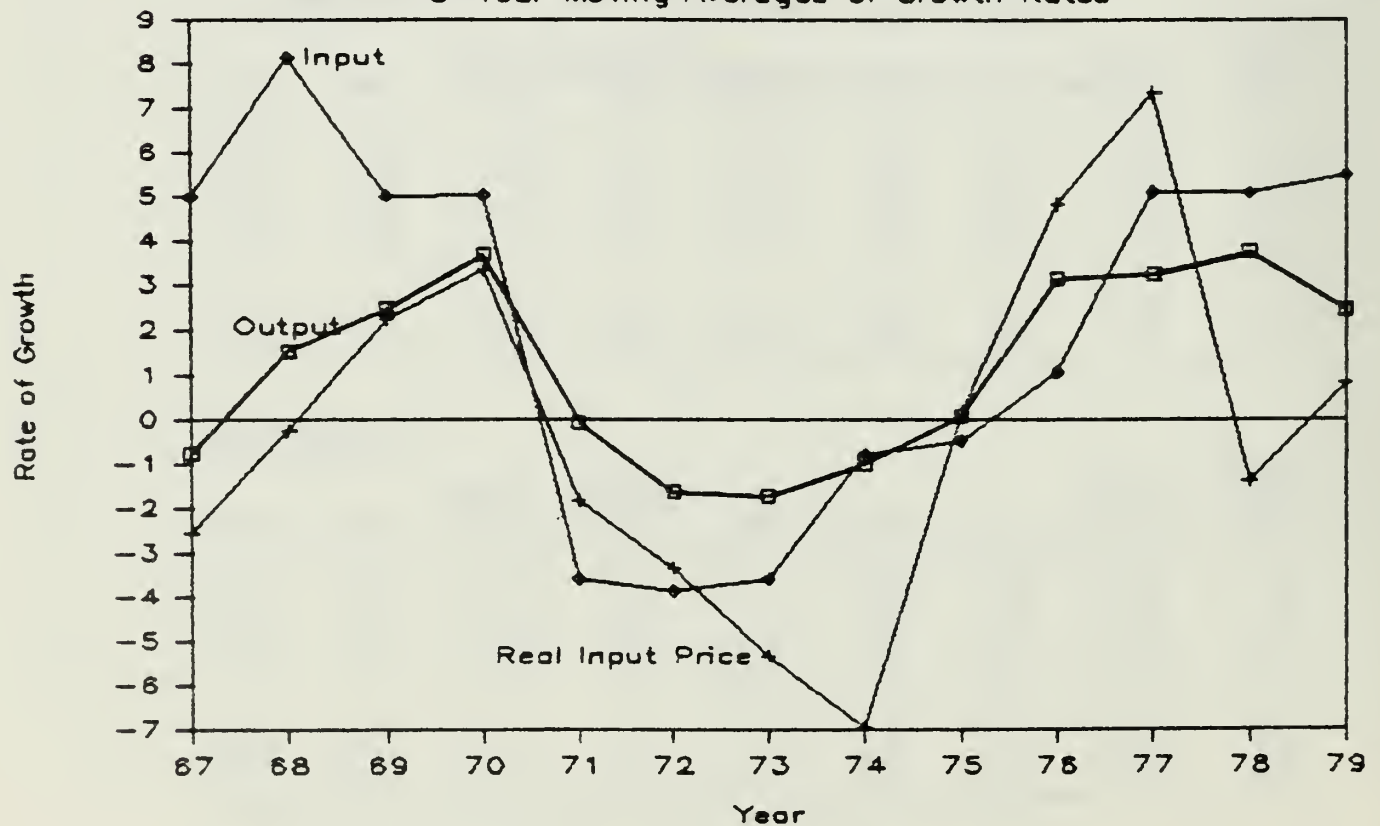
Figure 3. Middle Egypt

Aggregate Output, Input, and Prices
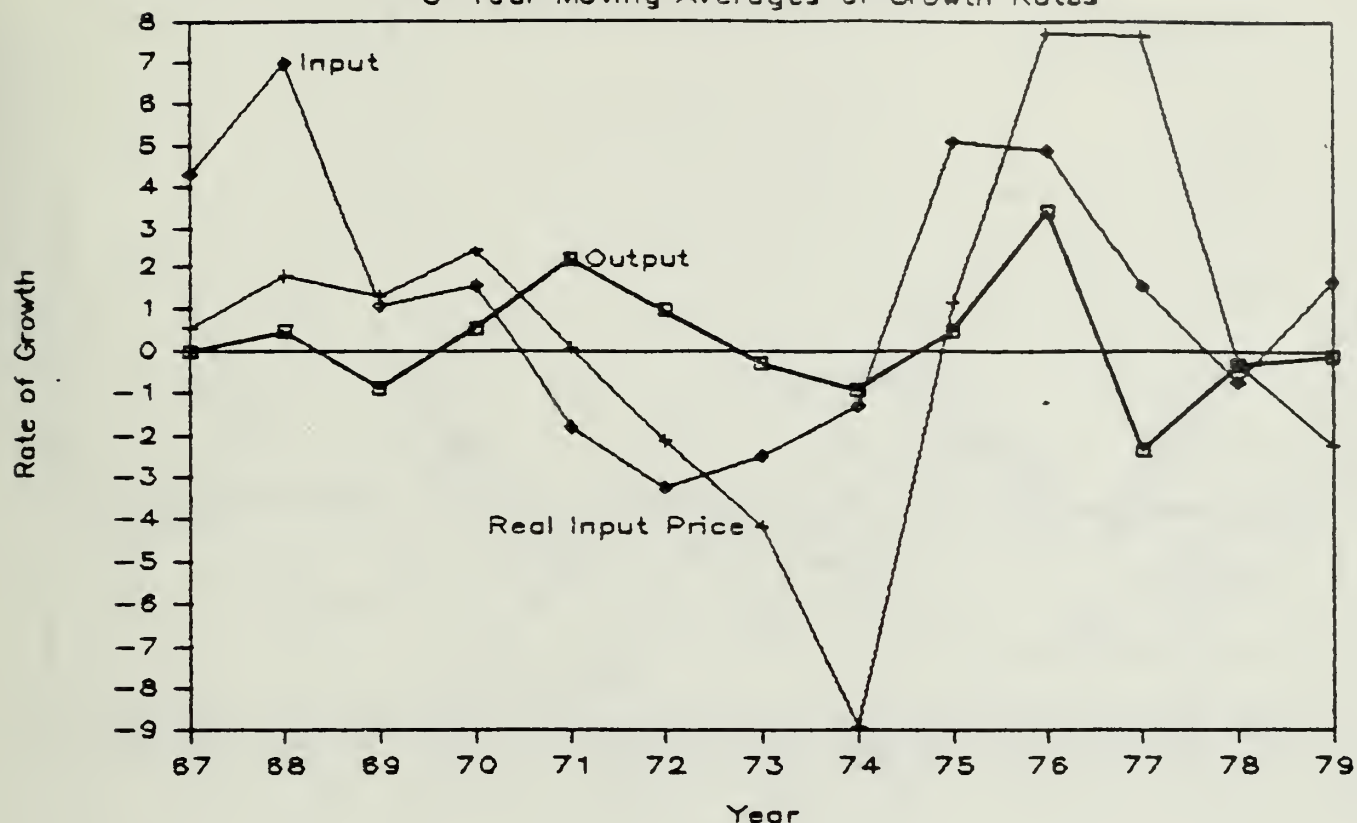### 3—Year Moving Averages of Growth Rates

Figure 4. Upper Egypt

Aggregate Output, Input, and Prices
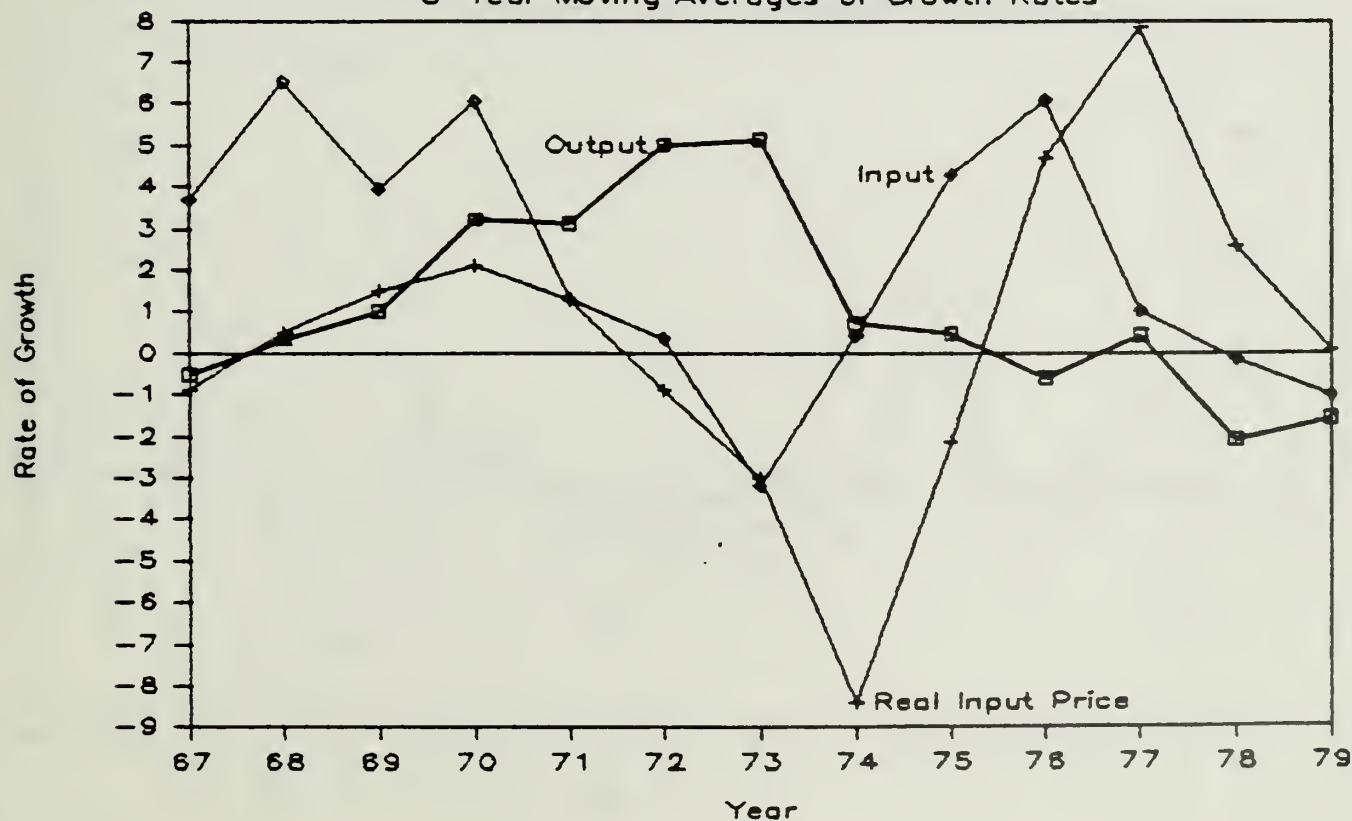### 3—Year Moving Averages of Growth Rates

Figure 5. Six Delta Governorates
Agricultural Employment and Real Wage
Annual Growth Rates: 1965–1979
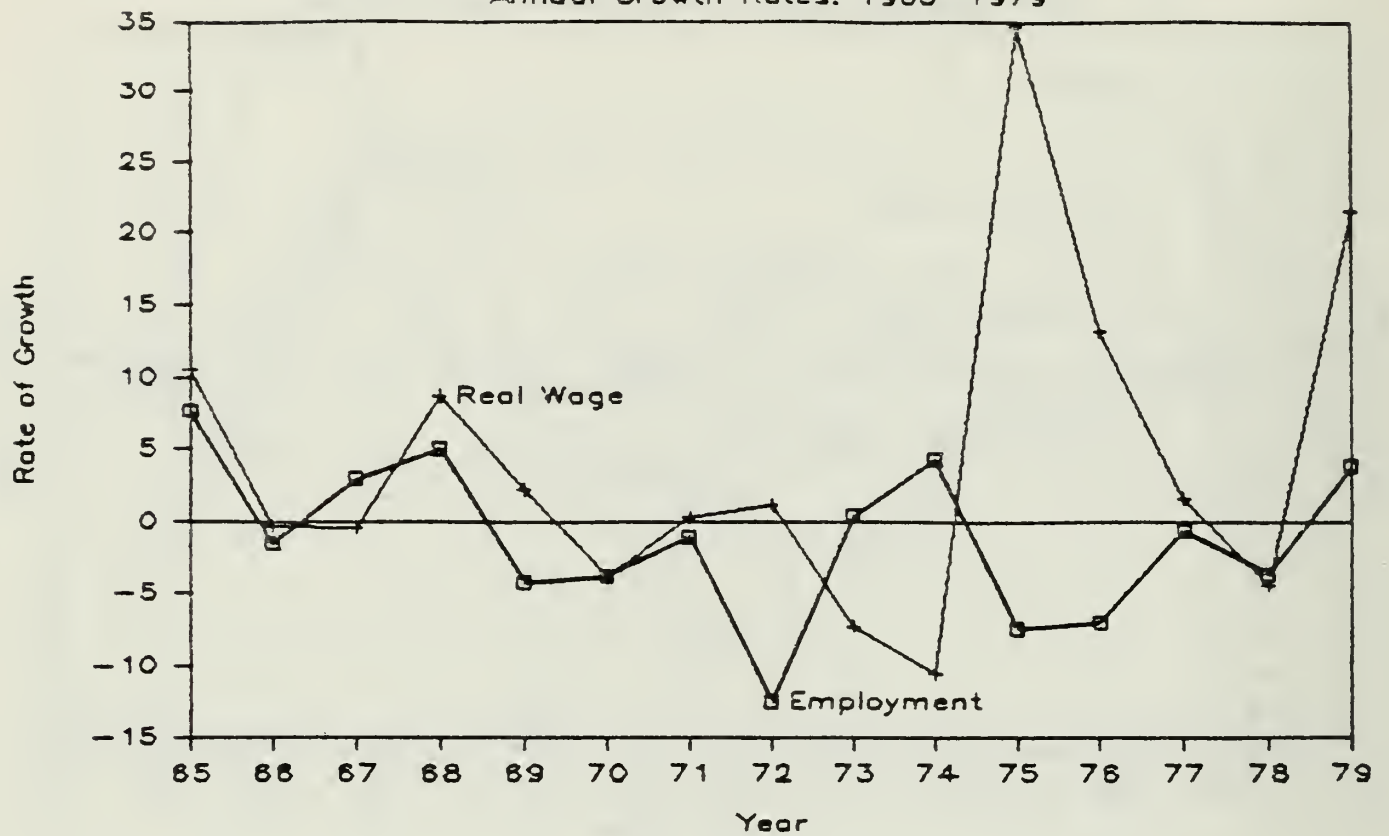
Figure 6. Urban Governorates
Agricultural Employment and Real Wage
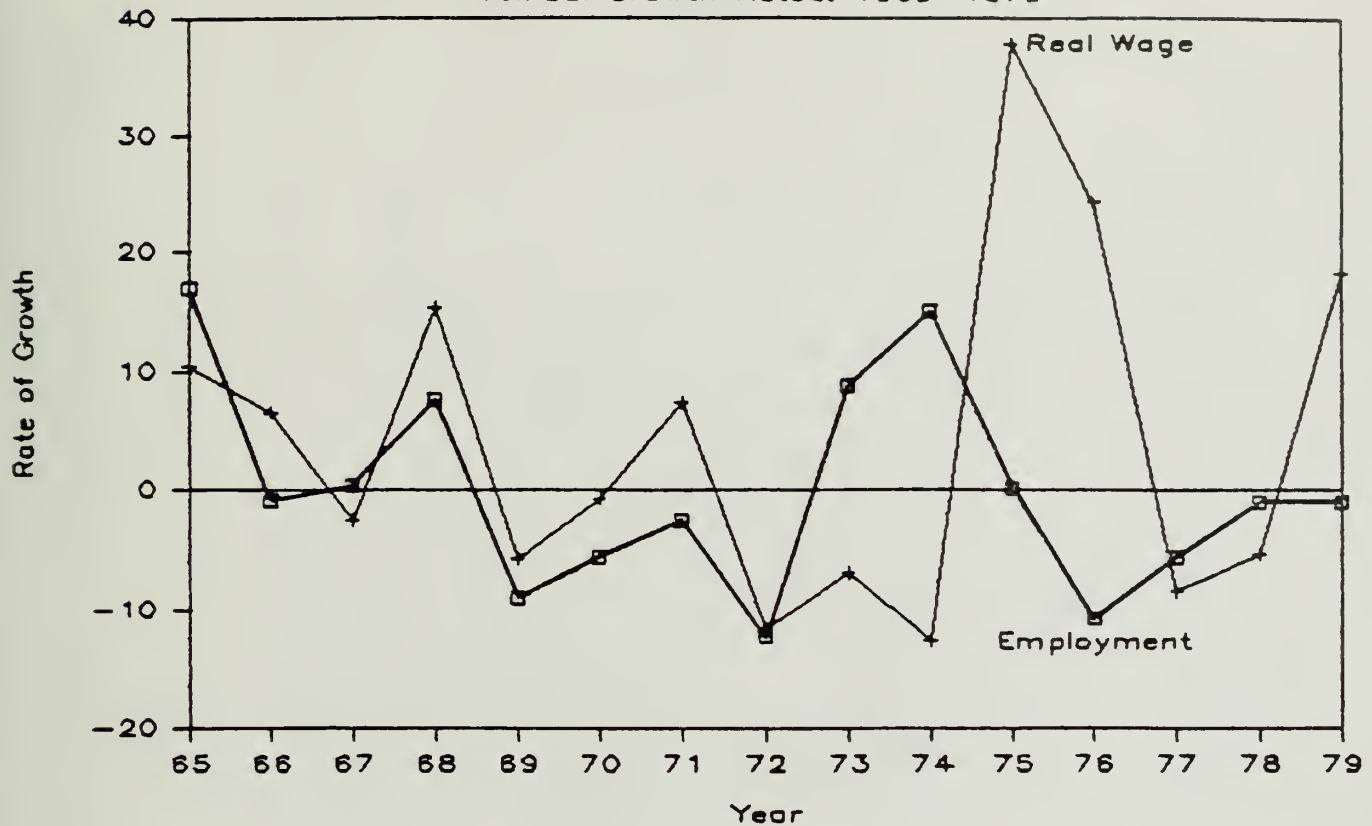Annual Growth Rates: 1965–1979
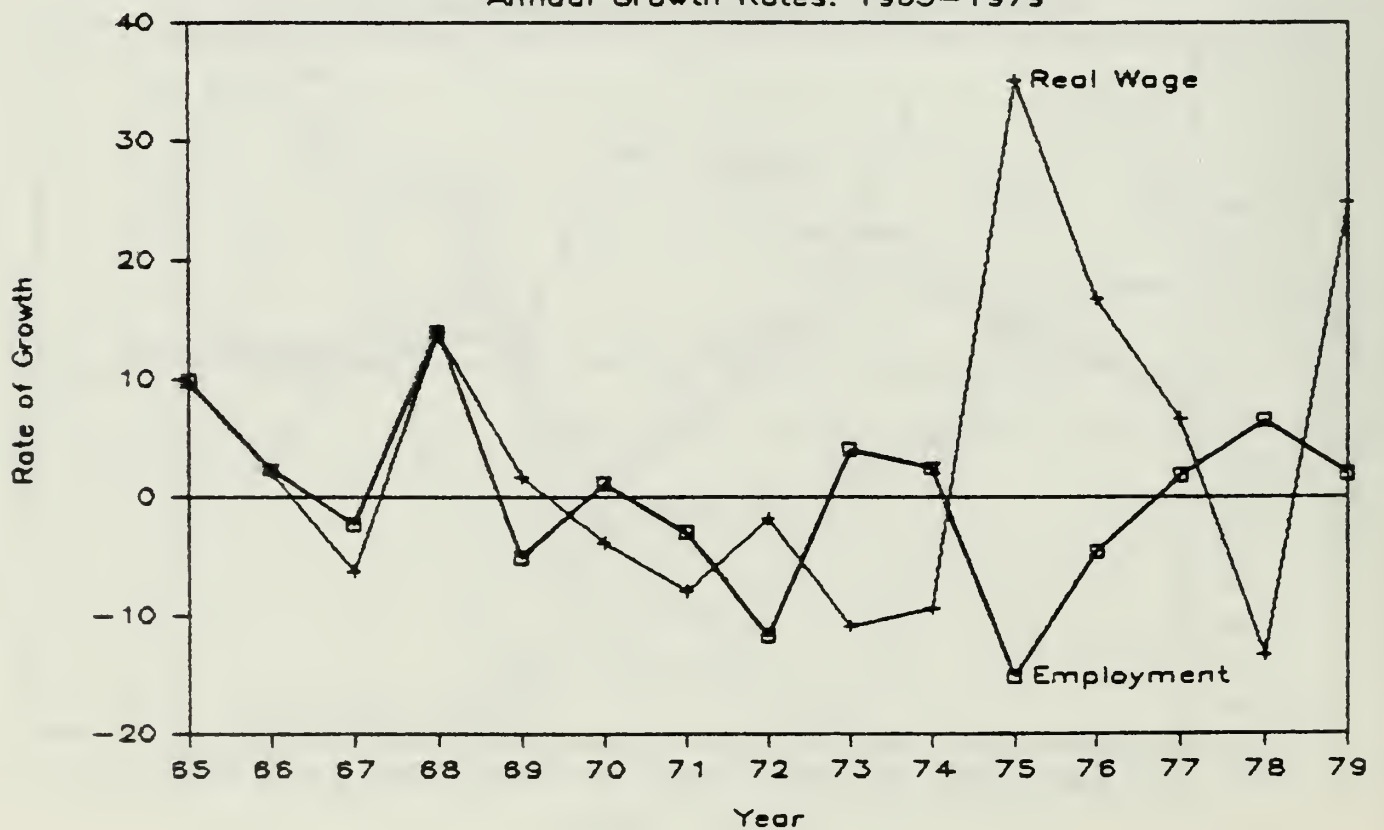
Figure 7. Middle Egypt

Agricultural Employment and Real Wage
Annual Growth Rates: 1965-1979

Figure 8. Upper Egypt

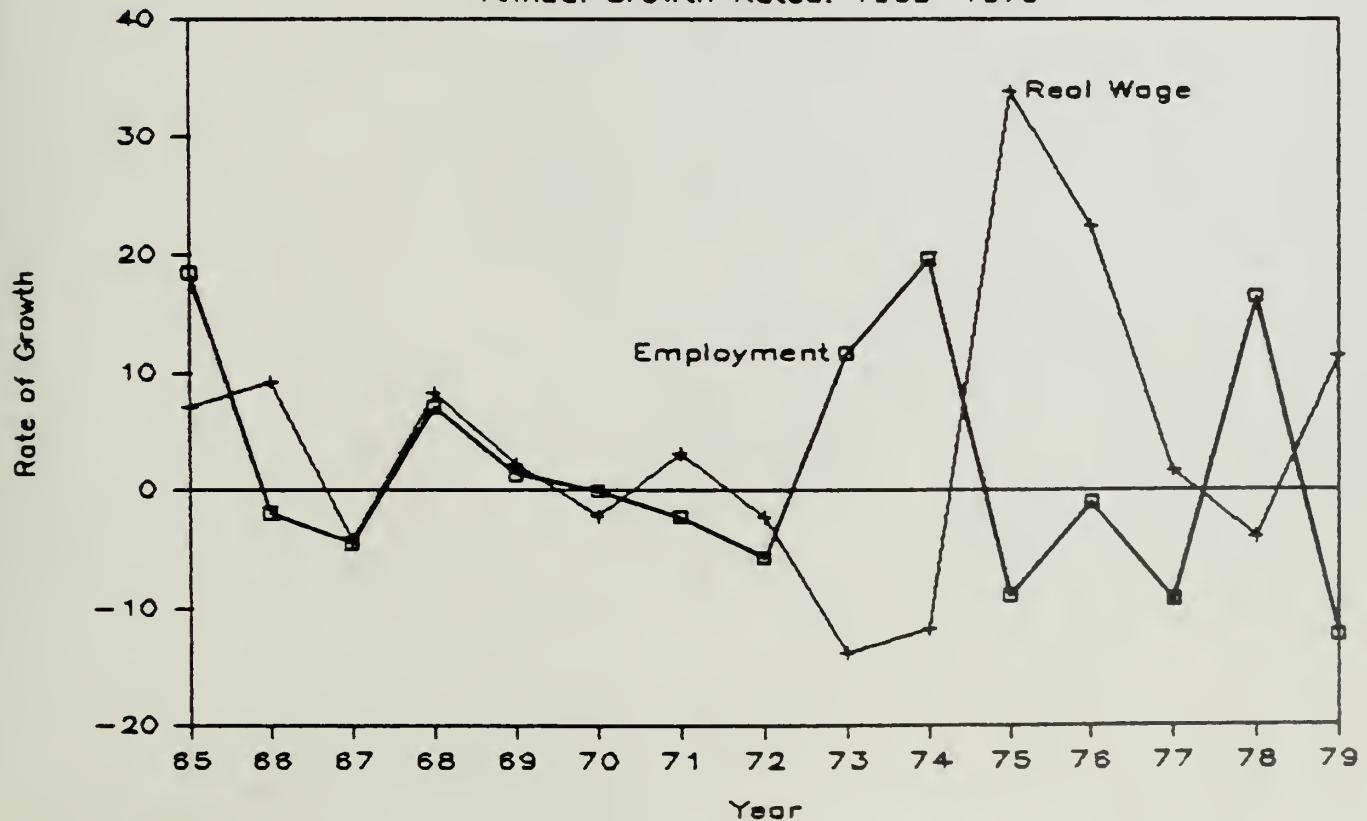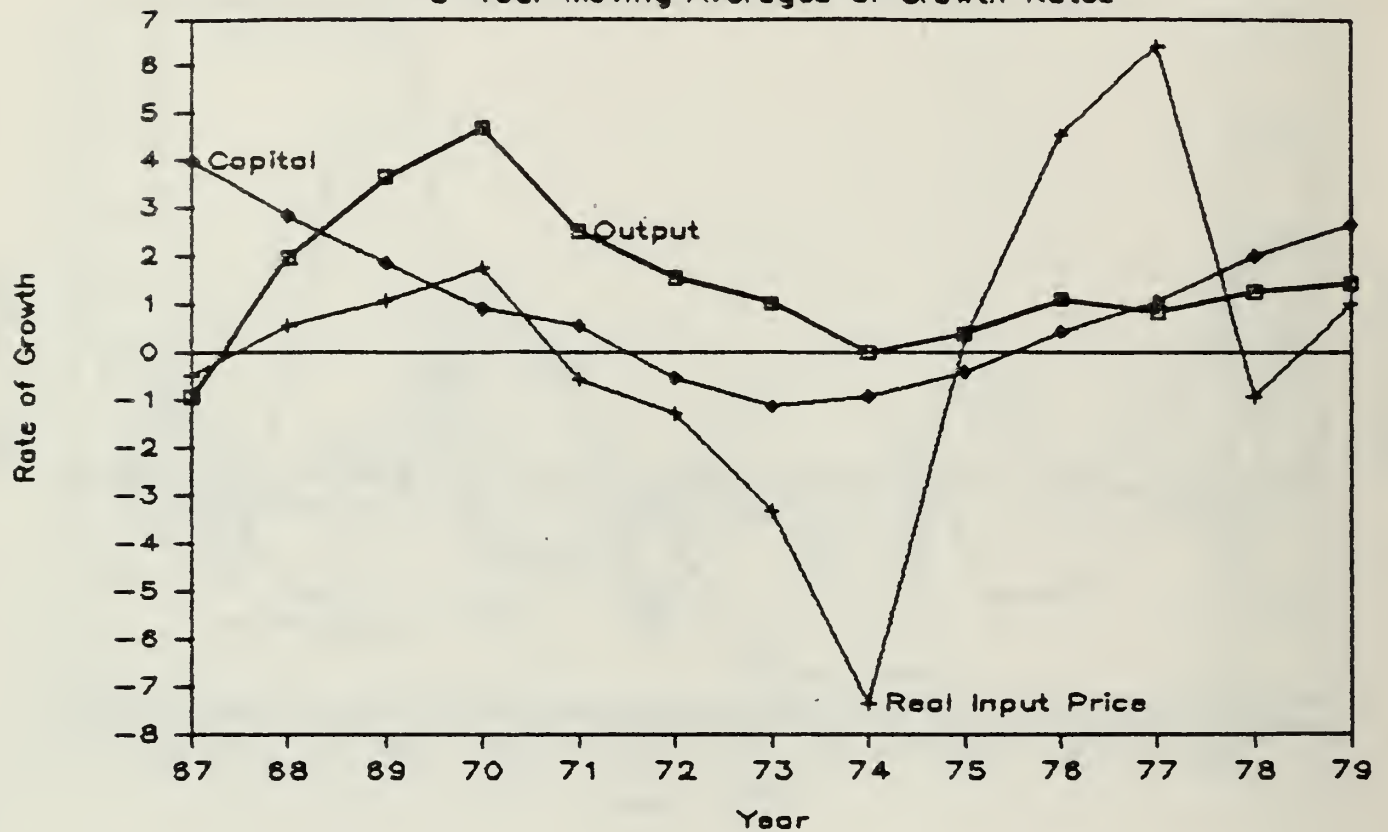# Agricultural Employment and Real Wage
Annual Growth Rates: 1965-1979

Figure 9. All Egypt
Production, Prices, and Infrastructure
3—Year Moving Averages of Growth Rates